# Kennedy NASA Procedural Requirements

**Effective Date:** **November 19, 2013**

**Expiration Date:** **November 19, 2018**

**Responsible Office:** **Spaceport Integration and Services**

# KSC HEARING LOSS PREVENTION PROGRAM

**National Aeronautics and Space Administration**

**John F. Kennedy Space Center**

KDP-KSC-T-2120 Rev. Basic

## Change Log

| Date | Revision | Description |
|---|---|---|
| 9/24/12 | B-1 | Replace reference to cancelled NPD 1820.1, NASA Environmental Health Program with NPD 1800.2C, NASA Occupational Health Program on page 4, P.3.c. |
| 11/19/13 | C | Global – Changed 'Health and Safety' to read "Safety and Health'<br>1.1.c., f. Clarify role of OHF in making recommendations for medical referrals to employers and employees.<br>1.5. Corrected title for the Medical and Environmental Support Contract (MESC)<br>1.5.l. Corrected reference to Respiratory Protection Program<br>1.6.a. Added 'as appropriate' to allow employer discretion to limit referrals to cases with work-related causality<br>1.6.c. Clarified role of Safety and Health organizations in requesting reassessment of noise hazards<br>1.8. Changed 'hearing Conservation Officer' to 'employer's Safety and Health Program'.<br>1.8.c. Added 'as appropriate' to allow employer discretion to limit referrals to cases with work-related causality<br>1.8.l. Clarified supervisors role in scheduling exit audiograms<br>2.2.b. Clarified Table reference<br>2.2.c. Clarified criteria for Hearing Conservation Program enrollment<br>2.3.a. Included reference and link for use of the NASA Buy Quiet Roadmap website<br>2.3.b. Clarified Table reference<br>2.4. (1) – (3) Added reference and link for use of the NASA Buy Quiet Roadmap website, added requirements for use of NASA Form 1707 for Civil Service procurement of hazardous noise equipment and KSC Form 28-1103 for contractor procurement of hazardous noise equipment<br>2.4.c. and c.(2) Clarified Table reference<br>2.5.b. Clarified requirement for labeling tools and equipment<br>2.5.c. Deleted reference to specification for warning signs<br>2.6.c. Clarified threshold for required use of hearing protection devices<br>2.6.d. Clarified requirement for hearing protection devices for employees with Hearing Threshold Shifts<br>2.6.f. Clarified requirement for de-rating of ear muffs and ear plugs<br>2.7.(2) Clarified threshold for identifying a high noise area<br>2.7.b., c. Clarified threshold for area noise monitoring and noise dosimetry monitoring<br>2.7.f. Clarified start date for employee notification of noise monitoring results<br>2.8.a. Clarified criteria for employee Hearing Conservation Program Enrollment<br>2.8.g. Deleted<br>2.8.h. Clarified requirement for transition of employee audiometric test records between employers during contract transitions.<br>2.9.j. Deleted audiogram age correction for personnel >60years.<br>2.9.l. Clarified criteria for audiogram retest<br>2.9.n. -Deleted reference to KSC Hearing Conservation Officer |

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| | | -Revised employer notification letter content to delete OSHA reference<br>2.11.b. Provided direction for reporting hearing loss to NASA IRIS mishap reporting system<br>Definition A.15 Deleted reference to Table 2<br>Table B Revised note to correct error (deleted 'fast response') |
| 5/18/15 | C-1 | Administrative changes made to reflect change in directorate name from Center Operations to Spaceport Integration and Services |

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## PREFACE

### P.1 Purpose

a. This Kennedy National Aeronautics and Space Administration (NASA) Procedural Requirements (KNPR) contains the requirements for the development, management, and implementation of the Kennedy Space Center (KSC) Hearing Loss Prevention Program. The primary objective of the Program is to implement Center policy and provide the requirements for the evaluation and control of workplace noise hazards and prevention of employee hearing loss.

b. It is KSC's policy to provide employees with an environment in which occupational health hazards are identified, evaluated, eliminated or controlled in such a manner that personnel do not suffer adverse health effects as a result of their employment. Activities shall be conducted in a manner that conforms to all applicable Federal, state and local regulatory requirements. Personnel exposures to chemical and/or physical agents will, at all times, be restricted to levels as low as reasonably achievable.

c. The requirements presented in this KNPR implement Federal Occupational Safety and Health Administration (OSHA) regulations and NASA management policy for Industrial Hygiene Programs. NASA, contractor management, and operations organizations shall supplement the provisions of these requirements by implementation of internal policies and instructions, as needed.

d. Additional requirements for the KSC Industrial Hygiene Program are contained within Kennedy NASA Policy Directive (KNPD) 1800.2, KSC Hazard Communication Program; KNPR 1820.4, KSC Respiratory Protection Program, and KNPR 1840.19, KSC Industrial Hygiene Programs.

### P.2 Applicability

a. This KNPR applies to all NASA organizational elements located at KSC, the United States (U.S.) Air Force 45th Space Wing, and NASA KSC facilities and operations at other locations. This includes associated contractors, to the extent specified in their respective contracts; carrier and payload organizations; and other government agencies, their contractors and tenants.

b. In this directive, all mandatory actions (i.e., requirements) are denoted by statements containing the term “shall.” The terms “may” or “can” denote discretionary privilege or permission, “should” denotes a good practice and is recommended, but not required, “will” denotes expected outcome, and “are/is” denotes descriptive material.

c. In this directive, all document citations are assumed to be the latest version unless otherwise noted.

### P.3 Authority

a. Executive Order 12196, Occupational Safety and Health Programs for Federal Employees.

b. Title 29, Code of Federal Regulations (CFR), Part 1960, Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters.

c. NASA Policy Directive 1800.2, NASA Occupational Health Program

d. NASA Procedural Requirements (NPR) 1800.1, NASA Occupational Health Program Procedures.

**P.4 Applicable Documents and Forms**

a. Privacy Act of 1974 as amended (5 U.S. Code Sec.552a Records Maintained on Individuals).

b. 29 CFR 1904, Recording and Reporting Occupational Injuries and Illnesses.

c. 29 CFR 1910.1020, Access to Employee Exposure and Medical Records

d. 29 CFR 1910.95, Occupational Noise Exposure.

e. 29 CFR 1926.52, Occupational Noise Exposure.

f. NPR 1441.1, NASA Records Retention Schedules

g. KNPD 1800.2, KSC Hazard Communication Program

h. KNPR 1820.4, KSC Respiratory Protection Program

i. KNPR 1840.19, KSC Industrial Hygiene

j. Special Approvals and Affirmations of Requisitions, NASA Form 1707

k. Initial Record of Injury/Illness , KSC Form 6-2

l. Pre-use Analysis Checklist, KSC Form 28-1103

m. National Institute for Occupational Safety and Health (NIOSH), Occupational Noise Exposure – Revised Criteria 1998.

n. American National Standards Institute (ANSI), Specification for Sound-Level Meters, ANSI Sl.4-1994.

o. ANSI, Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms, ANSI S3.1-1999.

p. ANSI, Specifications for Audiometers, ANSI S3.6-1996.

q. ANSI, Measurement of Sound Pressure Levels in Air, ANSI S1.13-1995.

r. ANSI, Measurement of Occupational Noise Exposure, ANSI S12.19–1996.

s. American Conference of Governmental Industrial Hygienists, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.

**P.5 Measurement/Verification**

None

**P.6 Cancellation or Supersession**

This revision supersedes KNPR 1820.3, Rev. C, KSC Hearing Loss Prevention Program.

*/original signed by/*
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## CHAPTER 1. Responsibilities

### 1.1 Occupational Medicine Officer

The KSC Occupational Medicine Officer, or designated representative, is responsible for:

a. Providing medical evaluations, obtaining occupational history of participants in the HCP, and evaluating test results.

b. Maintaining a record of personnel receiving HCP physical examinations and providing audiometric examinations for those persons.

c. Notifying employees in accordance with this KNPR of significant hearing loss or other medical pathology of the ear, and explaining needs and recommendations to the employer regarding further testing or referrals.

d. Notifying the employee and their employer within 21 days if further testing establishes a Standard Threshold Shift (STS) or deafness has occurred and initiating an industrial hygiene follow-up investigation of the employee's workplace.

e. Recommending the reassignment of employees to work in low noise areas, when necessary to prevent further significant hearing loss or the aggravation of other medical conditions that could be worsened by work in a high noise area.

f. Recommending employee referral to an audiologist or physician specialist, as appropriate.

g. Ensuring physicians who conduct or supervise the audiometric testing of employees have reviewed the requirements of this standard and 29 CFR 1910.95.

h. Ensuring audiometric tests are performed by a licensed certified audiologist, otolaryngologist, or other physician, or by a health professional under the supervision of a physician or audiologist.

i. Ensuring audiometric test equipment is properly calibrated and ambient noise levels in the audiometric test rooms meet the requirements within this KNPR.

j. Maintaining audiometric test records and other records.

k. Providing employee access to medical records in accordance with the requirements of paragraph 2.14.

l. Providing audiometric examinations and notifying employees of the need to avoid exposure to high noise levels preceding the audiometric test.

### 1.2 Human Resources Office

The Human Resources Office shall coordinate the reassignment of employees with the Occupational Medicine Officer, as required by paragraph 1.1.e.

### 1.3 KSC Institutional Support Services (KISS) Contractor

The KISS contractor, or other contractor training organizations shall, to the extent provided by

contract, provide HCP training and maintain associated employee training and certification records in accordance with the requirements of 29 CFR 1910.95.

### 1.4 KSC Industrial Hygiene Officer (IHO)

The IHO, or a designated representative, is responsible for implementing and administering the HCP.

### 1.5 The Medical and Environmental Support Contract (MESC)

MESC Industrial Hygiene Office is responsible for:

a. Providing baseline surveys on notification of each new operation, job, or procedure having the potential of creating a noise hazard.

b. Designating hazardous noise areas.

c. Maintaining an inventory of high noise areas including noise levels recorded in those areas.

d. Providing monitoring of hazardous, or potentially hazardous, noise areas or operations, including personnel noise dosimetry.

e. Providing followup investigations of employee workplaces for employees with an identified STS.

f. Providing the results of noise surveys and recommendations for control of noise hazards to supervisors, site managers, and responsible safety and health organizations in the affected work areas.

g. Notifying the employers of affected employees of the results of noise dosimetry monitoring.

h. Notifying supervisors or responsible safety and health organizations of the requirements for employees to participate in the HCP when monitoring data shows the employee's noise exposure exceeds the criterion for enrollment.

i. Reviewing facility and operational plans to assess the adequacy of precautions taken to control noise exposures.

j. Recommending methods to control hazardous noise exposure.

k. Maintaining records of noise surveys and providing employee access to those records.

l. Advising and assisting in the development of HCP Training courses.

m. Recommending and evaluating the selection of hearing protection devices to assure they provide adequate attenuation.

n. Coordinating with the Occupational Medicine Officer, or designated representative, to determine workplace causes of STS.

o. Monitoring background noise levels in audiometric booths used at KSC.

p. Providing consultation to procurement and engineering design organizations in implementing the requirements of NPR 1800.1 as it applies to “Buy Quiet/Design Quiet” elimination of hazardous noise sources.

### 1.6 Contractor Safety and Health Program

Contractor Safety and Health Program personnel are responsible for:

a. Referring personnel who complain of hearing loss or other hearing or ear problems to the Occupational Health Facility (OHF), as appropriate.

b. Enforcing the wearing of hearing protection devices, the posting of warning signs and labels, and implementation of administrative controls.

c. Ensuring the request for reassessment of noise hazards and exposures following any known changes in operations or procedures that may increase/decrease personnel exposure to noise.

d. Reporting work-related hearing loss to the NASA Incident Reporting Information System (IRIS).

### 1.7 Heads of Organizations

Heads of primary organizations and heads of contractor organizations are responsible for:

a. Implementing engineering and work practice controls where required to reduce or eliminate noise hazards.

b. Ensuring employees are provided HCP training in accordance with 29 CFR 1910.95 and this KNPR.

### 1.8 Supervisors

Supervisors are responsible for:

a. Coordinating with appropriate safety and environmental health personnel to request a workplace noise hazard assessment of operations with suspected noise hazards in all their areas of jurisdiction.

b. Providing the OHF the names of personnel working in hazardous noise areas or noise exposed jobs when identified by the employer’s Safety and Health Program.

c. Referring personnel who complain of hearing loss or other hearing or ear problems to the OHF, as appropriate.

d. Ensuring their employees keep their HCP examination appointments at medical facilities.

e. Ensuring provision of hearing protection devices, enforcing the wearing of hearing protection devices, and implementing recommended administrative controls.

f. Notifying the NASA IHO, or contractor Safety and Health organization, of any changes in operations or procedures which increase or decrease personnel exposure to noise.

g. Ensuring employees who are participants in the HCP attend annual training.

h. Attending HCP training, if supervising participants in the HCP.

i. Notifying affected employees of noise survey results.

j. Notifying each affected employee of noise dosimetry monitoring results.

k. Ensuring the posting of noise hazard warning signs, labels, and placards in their responsible work areas.

l. Scheduling an exit audiometric examination for employees enrolled in the HCP.

**1.9 Individual Employees**

Individual employees are responsible for:

a. Following control procedures established for maintaining effective noise exposure control, including wearing and maintaining hearing protective devices furnished for their protection.

b. Cooperating with supervisors, medical, environmental, and safety and health personnel in actions to evaluate noise hazards and to prevent hearing loss caused by excessive exposure to workplace noise.

c. Notifying supervisors of areas, operations, or equipment that may be a noise hazard.

d. Attending training and keeping medical appointments as required by this KNPR.

**1.10 Facility Managers**

Facility Managers are responsible for posting warning signs on facility equipment and entrances to high noise areas, in accordance with paragraph 2.5.

**1.11 Engineering Organizations**

Heads of engineering organizations are responsible for:

a. Assuring new facilities and equipment are designed, procured, operated, and maintained in such a manner, where feasible, as not to create a noise hazard.

b. Employing engineering methods that achieve long-term reduction in employee noise exposure when purchasing or designing mechanical systems expected to exceed noise emission levels of concern (80 decibels A-weighted [dBA]).

c. Coordinating the design and implementation of engineering noise control measures with the KSC IHO.

d. Coordinate with appropriate NASA and contractor safety and environmental health personnel to request a workplace noise hazard assessment of operations or procedures when changes occur which increase or decrease personnel exposure to noise.

## CHAPTER 2. Hearing Loss Prevention Program

### 2.1 General

The Hearing Loss Prevention Program includes elements toward a goal of preventing hearing loss and includes the observance of noise exposure limit, exposure assessments, engineering controls, administrative controls, hearing protection devices, medical surveillance, hazard communication, training, and records management.

### 2.2 Noise Exposure Limits

a. The noise exposure limit for an employee is an eight hour (8-hr) time-weighted average (TWA) of 85 dBA or an equivalent dose based on Table A, Appendix C. Exposures at or above 100% of the noise dose are considered hazardous. Unprotected exposures above 103 dBA are not allowed for any duration.

b. Exposure to impact or impulse noise shall not exceed the limits listed in Table B and Table A, Appendix C. No unprotected impact or impulse noise exposures in excess of 130 decibels (dB) peak sound pressure level are permitted.

c. An employer shall enroll personnel in the HCP if employee's exposure is equal to or greater than 85 dBA 8-hr TWA or routine (30 days or more per year) noise exposure equals or exceeds the action level (82 dBA 8-hr TWA or equivalent dose).

### 2.3 Engineering Control of Noise in Facility Design

a. Design shall endeavor to reduce employee noise exposures through procurement and design of equipment with the intention of achieving realistic and achievable noise criteria. Design will consider noise emission when designing and specifying equipment that is expected to generate noise emission levels exceeding 80 dBA. Guidelines and resources for identification, analysis and selection of low noise equipment are found at the NASA website Buy Quiet Roadmap. Engineering controls will be the first and primary means of controlling hazardous noise. Applicable facility plans will be reviewed to assess the adequacy of precautions that are planned or undertaken to control noise exposures. Engineering drawings, specifications, and operations concepts, including noise control measures, will be coordinated with the affected management organizations and the KSC IHO in the design or planning process.

b. If controls fail to reduce sound levels within the limits of Tables A and B, Appendix C, a warning sign shall be posted and hearing protection devices or administrative methods of noise exposure protection will be used.

### 2.4 Administrative Control of Noise

a. Operation organizations shall endeavor to reduce employee noise exposure through procurement of equipment with noise emission levels below the 80 dBA level of concern. Operation managers will specify low noise emitting equipment, where available, or include available noise-reducing accessories (e.g. mufflers, enclosures, etc.) as a part of equipment procurements.

1) Guidelines and resources for identification, analysis and selection of low noise equipment are found at the NASA website Buy Quiet Roadmap. MESC Environmental Health can provide assistance in selecting low noise equipment.

2) Purchase requests for Civil Service procurement of noise producing equipment (≥80 dBA) shall include a copy of a completed Special Approvals and Affirmations of Requisitions (NASA Form 1707, Section 6) and supporting information.

3) Purchase request for Contractor procurement of noise producing equipment (>80 dBA) shall include a copy of the completed Pre-use Analysis Checklist (KSC Form 28-1103) and supporting information.

b. Operation organizations shall perform necessary preventive maintenance of equipment and noise-reducing accessories as required to maintain low noise emissions.

c. When available controls do not reduce employee noise exposure below the thresholds identified in Tables A and B, Appendix C, a combination of the following measures shall be implemented:

1) Access of personnel to noise hazard areas shall be restricted to the minimum number and/or period of time required to perform a specific task or function.

2) Where Hearing Protection Devices are not sufficient to attenuate noise to less than 85 dBA 8-hr TWA, the duration of time spent in the noise hazard area shall be limited, not to equal or exceed the exposure limits in Tables A and B, Appendix C.

3) Warning signs shall be posted at the perimeter/entry of noise controlled work areas.

**2.5 Warning Signs**

a. When noise levels routinely equal or exceed 85-dBA 8-hr TWA, warning signs, which clearly indicate the hazard of high noise levels and state the requirement to wear hearing protection, shall be posted at the entrances to the area.

b. Decals or placards warning of the potential noise hazard shall be affixed to tools and machines that produce noise equal to, or greater than, 85 dBA at the operator's position.

**2.6 Hearing Protection Devices**

a. Earmuffs, and/or earplugs, shall be provided in accordance with 29 CFR 1910.95 and this KNPR. Such equipment will be issued for the exclusive use of each employee and will not be traded or shared.

b. Personnel shall wear hearing protection whenever engineering and administrative controls do not reduce employee noise exposure below the action level. Additionally, all persons working within a posted hazardous noise area without regard to their exposure duration will wear hearing protection when noise is present.

c. The use of hearing protection is required for all employees where sound levels reach or exceed 85 dBA.

d. Hearing protectors shall attenuate the employee's noise exposure to a level below the noise exposure limit of 85 dBA 8-hr TWA. For those with a STS, protectors will attenuate exposure to less than 8-hr TWA of 82 dBA.

e. A combination of both earmuffs and plugs are required where noise levels equal or exceed 100-dBA 8-hr TWA, and any exposure equal to or greater than 105 dBA.

f. Estimation of the adequacy of earmuffs and earplugs shall be performed according to a method specified in 29 CFR 1910.95, Appendix B. A de-rating of the noise reduction rating of 25% for muffs, and 50% for plugs will be used, or the direct application of the subject fit value from subject fit data based on ANSI S72-1998.

g. The adequacy of hearing protector attenuation shall be reevaluated whenever the employee's noise exposure increases to a level where the hearing protector provided may no longer provide adequate attenuation. More effective hearing protectors will be provided when necessary.

h. Where reusable earplugs are used, they shall be permanently issued to the employee, and the employee will be instructed in the proper method of insertion and cleaning of the earplugs. Employees will inspect reusable earplugs for cleanliness and to ensure that they are not damaged prior to each use. Damaged earplugs will not be used.

i. The user shall inspect earmuffs on a regular basis. Earmuffs that have been damaged, altered, or modified in any way will not be used in hazardous noise environments. Where replacement parts, such as ear cup seals are available, the earmuffs may be repaired and reused.

j. Special hearing protection equipment, such as sound-suppression communications and active noise reduction headsets may be used in hazardous noise environments. These devices shall be regularly inspected by the issuing agency. Headsets that have been damaged, altered, or modified will not be used in hazardous noise environments. Where headsets cannot be permanently issued to individuals, the issuer will assure the headsets are cleaned and sanitized before re-issuance.

### 2.7 Exposure Monitoring

a. An initial investigation of potentially hazardous sound levels shall be conducted when any information, observation, or calculation shows an employee may be exposed to a noise level of 82 dBA 8-hr TWA or greater. This identification includes, but is not limited to:

1) Representative measurements of noise exposure.

2) Employee complaints of excessive noise or any areas where it is difficult to understand a normal conversation when the speaker and listener face each other at a distance of approximately 3 feet or at arms distance.

3) New equipment, operations, jobs, or procedures with the potential for creating hazardous noise.

b. When any initial determination indicates any employee's noise exposure may equal or exceed the action level, area noise monitoring shall be conducted to establish the characteristics of the noise source, operations in the noisy area, the extent of the area that exceeds 85 dBA, the number of affected employees, and their exposure duration/frequency. When present, the initial determination will identify employee exposure to ototoxic chemicals and environmental conditions that may contribute to the noise hazard.

c. When an initial determination shows any employee or group of employees may be exposed to noise at or above the action level, noise dosimetry monitoring shall be conducted to determine the noise dose of the exposed employee and the representative exposure of similarly exposed employees, and to determine appropriate noise abatement techniques. Where

required, an octave band analysis will be conducted to determine the characteristics of the noise source and to enable the selection of engineering controls.

d. Monitoring which is representative of the noise exposure of employees in the work area shall be performed and repeated whenever any changes to facilities, equipment, work practices, procedures, or noise control measures could increase personnel noise exposure.

e. Employees and/or their representatives shall be provided an opportunity to observe noise dosimetry and area monitoring activities.

f. Affected employees shall be notified in writing of the results of noise dosimetry monitoring within 30 days of the employer's receipt of monitoring results.

g. As a minimum, sound-level meters shall meet the Type II requirements of ANSI Sl.4-1994 and will be capable of measuring sound in the range of 80-130 dBA. Measurement will be in accordance with ANSI S1.13-1995.

h. Noise dosimeters shall meet the Class 2A-90/80-5 requirements of ANSI Sl.25-1991 and will be capable of integrating sound levels of 80 decibels (dB) and above. Measurements will be made in accordance with ANSI S12.19-1996.

i. Noise exposure monitoring may be conducted using either a noise dosimeter or a sound-level meter. Where a sound-level meter is used to estimate an employee's noise dose, the survey shall include a time and motion study to document the variations in the employee's noise exposure during the working shift.

j. Reports shall be consistent with the report requirements identified in KNPR 1840.19 section 2.3.l. Report Requirements for Health Hazard Evaluations.

**2.8 Hearing Conservation Program (HCP) Enrollment**

a. Whenever an employee's occupational exposure is equal to or greater than the exposure limit or is occupationally exposed above the action level for 30 or more days per year the employee shall be enrolled in a HCP. For the purposes of HCP enrollment, the employee's noise exposure will be determined without regard to any sound attenuation provided by the use of hearing protectors.

b. Prior to placement in a job requiring participation in the HCP, and annually thereafter, each employee shall undergo an examination by a physician or other qualified health professional with review by a physician.

c. The examination shall include an audiogram, a medical examination to determine any medical pathology of the ear, a work history to document past noise exposure, and a medical history to include use of ototoxic medications. If an employee is determined to be suffering from a medical condition that may compromise the validity of the test, the audiogram will be delayed until the condition has abated.

d. Personnel performing audiometric examinations shall maintain current certification by the Council for Accreditation in Occupational Hearing Conservation.

e. When a physical examination cannot be obtained prior to placement in a job requiring participation in the HCP, or when it is discovered those already assigned to noise-hazard areas have not had a physical exam, one shall be conducted within 30 days thereafter. The baseline audiogram will be preceded by a period of at least 14 hours during which there is no known

exposure to sound levels in excess of 80 dBA. Personal hearing protection devices that reduce the employees' exposure to 80 dBA TWA or below are allowable. This time interval will be sufficient to allow recovery from noise-induced temporary threshold shift.

f. Employees exhibiting a preexisting medical pathology shall require a review prior to being assigned to work in conditions that may aggravate their medical condition or work safely in hazardous areas. This includes persons who are considered legally deaf, hearing disabled, or who exhibit medical pathologies that prohibit the use of hearing protectors.

g. An exit audiogram shall be provided to employees enrolled in the HCP on termination of employment, transfer to duties with no hazardous noise exposure, transfer to another installation, or retirement. An annual audiogram dated within 6 months may be substituted for an exit audiogram.

h. When employees at a Center retain their "work role position" but change employers due to contract award to a new employer, all medical records applicable to hearing conservation shall follow them to their new employer, including their current baseline threshold.

**2.9 Audiometric Testing**

a. An audiologist, otolaryngologist or other qualified physician, occupational health nurse or technician may perform audiometric testing. Technicians and nurses who perform audiometric tests shall be under the supervision of an audiologist, otolaryngologist, or other physician. Personnel overseeing audiometric testing will maintain current certification by the Council for Accreditation in Occupational Hearing Conservation.

b. Audiometric tests shall consist of pure tone, air conduction, hearing threshold exams with test frequencies at 500, 1000, 2000, 3000, 4000, 6000, and 8000 hertz (Hz) in each ear. Hearing threshold levels will be determined by audiometers calibrated to the zero reference levels of the ANSI S3.6-1996 standard for audiometers. Audiometric test equipment will meet the specifications, maintenance and use requirements of ANSI S3.6-1996. Where a pulsed-tone, self-recording audiometer is used, it will also meet the requirements of 29 CFR 1910.95 Appendix C.

c. The audiologist or audiometric technician shall perform a listening check daily, prior to use, to assure the device is free from distorted or unwanted sounds.

d. A functional test shall be performed each day, either using an "acoustical ear" calibrator (dBA) Sound Level Meter (SLM) with 9A Type Earphone Coupler, or a "biological check," by testing an individual with a known and stable hearing baseline. A record will be kept of the daily tests. Deviations of 5 dB or more require an acoustical calibration test.

e. An electroacoustic calibration test (using a SLM, octave band filter set and a National Bureau of Standards 9A Coupler) shall be performed at least annually (semiannually for self-recording audiometers) or when a listening check indicates a deviation of 5 dB or more. The calibration test will conform to the requirements of 29 CFR 1910.95 Appendix E. Deviations of 10 dB or more will initiate an exhaustive calibration.

f. A complete calibration shall be performed at least every 2 years or whenever an acoustic calibration test indicates an error of 10 dB or more. The tests will meet the criteria of ANSI S3.6-1996. Following the calibration, the front panel of the audiometer will be labeled with a tag indicating calibration to ANSI S3.6-1996 and the date of the calibration.

g. Rooms used for audiometric testing shall not have background sound pressure levels exceeding those in Table C, Appendix C. Sound pressure levels in rooms used for audiometric testing will be tested using a Type 1 sound level meter no less than one (1) time a year.

h. Annual audiograms shall be preceded by at least 14 hours without exposure to workplace noise. Hearing protectors may be used to prevent noise exposure during this period. Employees will be notified, in writing, of the need to avoid high levels of occupational and non-occupational noise during the 14 hours preceding the audiometric test.

i. In addition to audiometric test data, each audiogram will, as a minimum, identify the audiometric reference level to which the audiometer was calibrated at the time of testing; the date of the audiogram; the examiners name; the date of the last calibration of the audiometer; and the name, employee number, and job classification of the individual tested.

j. A qualified physician shall compare the employee's baseline audiogram to the Annual audiogram to determine if the audiogram is valid and if a STS has occurred. When determining if a STS has occurred, allowance may be used for the contribution of aging to the hearing threshold level by adjusting the audiogram. The procedure described in 29 CFR 1910.95 Appendix F will be used.

k. Audiograms for each ear shall be separately tracked.

l. When the evaluation of an audiogram indicates a STS has occurred, a retest shall be scheduled to occur within 30 days to determine if the shift is persistent. A permanent STS has occurred when the retest confirms the original audiogram results and the better of the two audiograms will become the confirmed STS. If a retest is not performed, the STS will become a confirmed STS by default.

m. The annual audiogram may be substituted for the baseline audiogram when, in the opinion of the audiologist, otolaryngologist, or examining physician, the hearing threshold shown in the annual audiogram indicates a permanent threshold shift or significant improvement over the baseline audiogram. This audiogram shall be used for comparisons with future annual audiograms.

1) A significant improvement is shown if the average of thresholds at 2K, 3K, and 4 kilohertz (KHz) for either ear shows an improvement of 5 dB or more from the baseline and the improvement is persistent in the next audiogram. Age corrections may not be used in determining improvement.

2) When the professional evaluating the audiogram determines that a baseline revision is appropriate, whether due to a persistent STS or improved thresholds, the baseline shall be revised for each ear separately. A baseline audiogram that shows a persistent shift for only one ear may be revised for only that ear. The baseline may not be revised for the other unaffected ear. This procedure is required because it provides a clear indication of how each ear is affected by noise.

n. If a permanent STS is determined, the employee shall be evaluated by a physician to determine if the hearing loss is most likely noise induced or whether other medical pathology is suspected. The Initial Record of Injury/Illness form (KSC Form 6-2) will be used to notify the employee’s supervisor, safety and health office, Workers’ Compensation office, and MESC

Environmental Health of a permanent STS. A separate letter is provided to the employer for use to ensure employees notification of audiometric results. If further evaluation by an audiologist or otolaryngologist is recommended to provide further testing or to diagnose other pathology, the recommendation for referral will be indicated on the KSC Form 6-2. If it can be determined that the STS is not work related or aggravated by occupational noise exposure, a KSC 6-2 will not be completed, although a new reference audiogram may need to be established.

**2.10 MESC Medical Referrals**

a. Criteria for referral to an audiologist.

1) Baseline Audiogram indicating:
Average loss greater than 25 dB for 500, 1000, 2000 and 3000 Hz in either ear.
Average difference between ears of: greater than 15 dB for 500, 1000, and 2000 Hz, or greater than 30 dB for 3000, 4000, and 6000 Hz.

2) Annual Audiogram indicating:
Change for the worse in average hearing level in either ear compared to the baseline audiogram: greater than 15 dB for 500, 1000, and 2000 Hz, or greater than 20 dB for 3000, 4000, and 6000 Hz.

3) Variable or inconsistent responses or unusual hearing loss curves.

b. Criteria for examination by a qualified physician.

1) Presence and persistence of ear pain; drainage; dizziness; severe persistent tinnitus; sudden, fluctuating or rapidly progressive hearing loss, fullness or discomfort in one or both ears; or a history of these within the last 12 months.

2) Where an employee has previously received an otologic evaluation on the basis of failing on the above criteria, a re-evaluation shall be done if ear pain, drainage, dizziness, severe persistent tinnitus develops, or if a significant change in hearing levels is observed.

3) Where an employee suspects a medical pathology of the ear is caused or aggravated by the use of hearing protectors.

4) A person possesses good hearing in only one ear (severe unilateral loss).

5) A person who has chronic otologic problems (such as chronic otitis media or chronic otitis externa, especially if the condition prevents use of personal hearing protection.

6) A person with diplacusis, fullness, inconsistent audiometric findings or other puzzling ear symptoms.

7) Earwax accumulation sufficient to completely obstruct the view of the eardrum with otoscopy or foreign body in the ear canal.

8) Where the examining physician refers an employee to a physician specialist, communication of relevant medical data shall be provided upon request.

### 2.11 Follow-Up Review

When a work related hearing loss is detected, a followup review shall be conducted.

a. The employee's work area shall be investigated to determine if work practices or changes in equipment or procedures have increased the noise hazard.

b. Work-related hearing loss shall be reported to the NASA IRIS. Hearing loss that meets the definition of deafness will be reported as a Type B mishap. Other OSHA recordable hearing loss will be reported as a Type D mishap. An STS that does not meet the definition of an OSHA recordable incident will be reported as a Close Call.

c. The employee shall be retrained on the hazardous effects of noise and the need to use hearing protection.

d. The employee shall be refitted with hearing protectors offering greater sound attenuation, if needed.

e. When hearing protectors have not been previously used, the employee shall be fitted with hearing protectors and will be provided training in their use.

f. The employee's supervisor and responsible safety and health program office shall be notified of the occurrence of a STS or other work related hearing loss and any necessary abatement actions identified in the follow-up investigation of the employee's workplace.

g. When an OSHA recordable STS has occurred, employers shall record the condition as a hearing loss on the OSHA 300 Log and maintain the record in accordance with 29 CFR 1904, Recording and Reporting Occupational Injuries and Illnesses. A STS is recordable when:

1) The age-corrected audiogram identified a STS of 10 dB or more (averaged at 2K, 3K, and 4 KHz) in either or both ears.

2) The uncorrected hearing threshold level (averaged at 2K, 3K, and 4 KHz) is 25 dB or greater above audiometric zero in the ear(s) with an STS.

3) The STS is work-related.

h. The employee shall be reassigned to work in a low-noise area when recommended by a physician to prevent a compensable hearing loss. These employees will continue to participate in the HCP.

### 2.12 Employee Training

a. Each employee who participates in the HCP shall receive annual training. The training will include, as a minimum, an overview of 29 CFR 1910.95 and this KNPR, a review of the effects of noise, ototoxic chemicals and other factors that may contribute to hearing loss; identification of typical hazardous noise sources found at KSC; the purpose of hearing protectors; the advantages, disadvantages, and attenuation characteristics of various types of protectors; noise control principles; instruction on selection, fitting, use, and care of hearing protectors; an explanation of the audiometric testing procedure and the purpose of audiometric testing; and employee responsibilities in the HCP.

b. Personnel shall be encouraged, during all training opportunities, to use hearing protectors whenever they are exposed to noise during off-duty activities (e.g., from lawn mowers, firearms, etc.).

c. Supervisors of personnel participating in the HCP shall also receive hearing conservation training.

### 2.13 Employee Access

Copies of this KNPR, 29 CFR 1910.95 (OSHA Occupational Noise Exposure), and any appropriate records regulated by this standard shall be provided, upon request, to employees, former employees, representatives of employees, representatives of the U.S. Department of Labor, NIOSH, and NASA Headquarters Staff. Privacy Act provisions will be adhered to as applicable. The current version of this directive is available electronically on Business World.

### 2.14 Records

a. Audiograms and associated medical records, employee noise exposure measurements, measurements of the background sound pressure levels of audiometric test rooms and employee training records shall be maintained in accordance with the requirements of 29 CFR 1910.95 and NPR 1441.1, NASA Records Retention Schedules.

b. Industrial Hygiene records shall be maintained to document employee exposure, for future epidemiology studies, regulatory compliance verification, and exposure analysis.

1) Employee exposure records associated Industrial Hygiene survey records, document reviews, and equipment maintenance and repair records shall be maintained in accordance with 29 CFR 1910.1020.

2) It is the responsibility of each employer to maintain employee exposure and survey records for their affected employees.

## Appendix A. Acronyms

| | |
|---|---|
| ANSI | American National Standards Institute |
| dB | decibels |
| dBA | decibels A-weighted |
| CFR | Code of Federal Regulations |
| HCP | Hearing Conservation Program |
| Hz | Hertz |
| IHO | Industrial Hygiene Officer |
| IRIS | Incident Reporting Information System |
| Imp\day | Impulses or Impacts per day |
| KISS | KSC Institutional Support Services |
| KNPD | Kennedy NASA Policy Directive |
| KNPR | Kennedy NASA Procedural Requirements |
| L | Exposure level |
| KHz | Kilohertz |
| KSC | Kennedy Space Center |
| MESC | Medical and Environmental Support Contract |
| NASA | National Aeronautics and Space Administration |
| NIOSH | National Institute for Occupational Safety and Health (NIOSH |
| NPR | NASA Procedural Requirements |
| OHF | Occupational Health Facility |
| OSHA | Occupational Safety and Health Administration |
| SLM | Sound Level Meter |
| STS | Standard Threshold Shift |
| T | Time in minutes |
| TWA | Time-Weighted-Average |
| U.S. | United States |

**Appendix B. Definitions**

Action Level - Continuous noise, greater than or equal to a noise dose, in excess of 50% of the noise exposure limits listed in Appendix C, Table A, measured with a dosimeter or sound-level meter on the A-weighted scale, slow response. The action level is criterion for workplace monitoring. Employee exposures that reach this level on 30 or more days per year require participation in the HCP.

Administrative Controls - Any procedure limiting daily exposure to noise by control of the work schedule, work area, or work practices.

Annual Audiogram - Annual audiometric test, obtained subsequent to the baseline audiogram, which is used to detect shifts in the individual's threshold of hearing.

Audiogram - Chart, graph, or table resulting from an audiometric test. An audiogram shows an individual's hearing threshold levels as a function of frequency.

Audiologist - Professional specializing in the study and rehabilitation of hearing, which is certified by the American, Speech, Hearing, and Language Association, or licensed by a state board of examiners.

Audiometer - Electronic instrument used for measuring hearing threshold levels that conforms to requirements and specifications of ANSI S3.6-1996.

Baseline Audiogram - Audiogram against which future audiograms are compared.

decibel (dB) - A unit of measurement of sound pressure level.

decibels A-Weighted (dBA) - Unit of measurement of sound level corrected to the A-weighted scale (reference ANSI Sl.4-1994), as measured by a sound level meter.

Deafness - The otological condition in which the hearing threshold level for speech, or the average hearing threshold level for pure tones at 500, 1000, 2000, and 3000 Hz is at least 93 dB (reference ANSI S3.6-1996). This is generally accepted as representing a hearing loss disability for normal speech.

Diplacusis - Condition in which one sound is heard differently by the two ears resulting in the perception of two sounds instead of one.

Engineering Control - Any mechanical device or physical barrier that reduces the sound level at the source of noise or along the path of propagation of the noise to the individual, not including personal protective equipment such as ear muffs or earplugs.

Exchange Rate - The increase in sound level allowed for a corresponding halving of exposure time. (Also called doubling rate and trading ratio)

Hazardous Noise - A noise hazard exists wherever any operation, process, or procedure generates noise of sufficient duration and intensity to be capable of producing a permanent loss of hearing to unprotected persons when exposed over a working lifetime.

Hazardous Noise Area - Any work area where personnel could be exposed to noise levels equivalent to 85 dBA or greater and Table B.

Hertz (Hz) - A unit or measurement of frequency, numerically equal to cycles per second.

Impulsive or Impact Noise - Variations of noise level involving peaks of intensity occurring at intervals of more than one second. If the noise peaks occur at intervals of less than one second, the noise is considered continuous.

Medical Pathology - Disorder or disease. For the purposes of this KNPR, a condition or disease affecting the ear, which a physician specialist shall treat.

Noise - Generally unwanted sound. May also include desired sound (PA systems, alarms, etc.).

Noise Dose - A cumulative measure of noise exposure which takes into account both the intensity of sounds and the duration of exposure to noise during the work shift.

Noise Dosimeter - An electronic instrument that integrates cumulative noise exposure over time and measures noise dose.

Noise Control Area - An area in which noise is 85 dBA or greater. This designation is independent of duration.

Octave Band Analysis - An analysis of the standard frequency ranges (31.5 Hz - 16k Hz) used to characterize noise. The frequency of each band is such that the upper band limit is twice the lower band limit. Octave band analysis is often used as a means to determine materials and methods used for controlling noise.

Otitis Media - Infection and inflammation of the middle ear space and ear drum.

Otitis External - Infection and inflammation of the external ear canal.

Otolaryngologist - Physician specializing in diagnosis and treatment of disorder of the ear, nose, and throat.

Representative Exposure - Measurement of an employee's noise dose or 8-hr TWA noise exposure that is representative of the exposure of other employees in that work area or job classification who perform the same tasks and who are exposed to the same noise hazards.

Standard Threshold Shift (STS) - An average hearing threshold shift of 10 dB or more at 2000, 3000, and 4000 Hz; in either ear relative to the baseline audiogram or to the most recent audiogram which has established a STS.

Sound Pressure Level - Mathematically equivalent to ten times the common logarithm of the ratio or the square of the measured A-weighted sound pressure to the Standard reference pressure of 20 micropascals (measured in decibels).

Sound-Level Meter - Electronic instrument for the measurement of sound level.

Time-Weighted-Average (TWA) - Sound level which, if constant over an 8-hour workday exposure, would result in the same noise dose as is measured.

Tinnitus - A noise in the ears, as ringing, buzzing, roaring, clicking, etc.

## Appendix C. Tables

### Table A: Noise Exposure Limits [1] For Continuous Noise

| DURATION | | EXPOSURE LEVEL[2] dBA |
|---|---|---|
| (hours) | (minutes) | |
| 16 | 960 | 82 |
| 8 | 480 | 85 |
| 4 | 240 | 88 |
| 2 | 120 | 91 |
| 1 | 60 | 94 |
| 0.5 | 30 | 97 |
| 0.25 | 15 | 100 |
| 0.125 or less | 7.5 or less | 103 |

[1] Using:
Exchange Rate = 3 dB
Lower Threshold = 80 dB, $T=480/2^{(L-85)/3}$ (T=time in minutes and L=exposure level)
Meter set to slow response

[2] The exposure noted for each sound level for the duration noted is equivalent to 100% of the allowed noise dose. The Action Level is any exposure equivalent to 50% of the exposure duration in this Table.

### Table B: Noise Exposure Limits For Impact or Impulsive Noise

| SOUND LEVEL (dB)* | PERMITTED NUMBER OF IMPULSES OR IMPACTS PER DAY (imp/day) |
|---|---|
| >130 | none |
| 130 | 100 |
| 120 | 1,000 |
| 110 | 10,000 |
| *Decibels peak sound pressure level measured with a Type I/II sound level meter with peak hold feature using Z, C-weighting, or linear scale. | |

**Table C: Maximum Background Sound Pressure Levels For Audiometric Test Rooms**

| OCTAVE BAND CENTER FREQUENCY (Hertz) | SOUND PRESSURE LEVEL (dB) |
|---|---|
| 500 | 27 |
| 1000 | 26 |
| 2000 | 34 |
| 4000 | 37 |
| 8000 | 37 |
| 1000 to 8000 Hz based on ANSI S3.1; exceeds 29 CFR 1910.95 & AFR 161-15; 500 Hz based on AFR 161-15 and exceeds 29 CFR 1910.95 | |